AN3189
Application note

Demonstration board for Bluetooth® module class 2 SPBT2532C2.AT

Introduction

This user manual describes the STEVAL-SPBT2ATV2 demonstration board (dongle) for the Bluetooth® class 2 SPBT2532C2.AT module.

The dongle includes the module under evaluation, an RF antenna, and a USB connector.

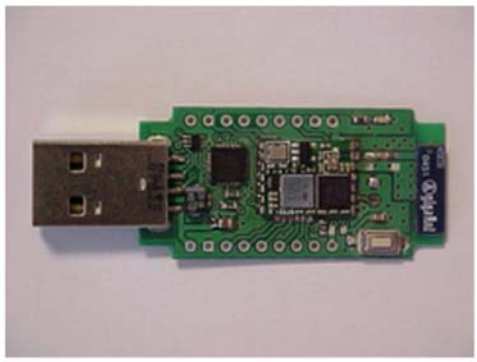
The USB connector is used to connect the dongle with a PC, to access the Bluetooth module and to supply the dongle.

The STEVAL-SPBT2ATV2 is a board with downloaded FW which enables the user to create a Bluetooth link with simple AT commands.

It is an easy solution to test and operate with the SPBT2532C2.AT module. The features are:

- Bluetooth V2.1 board
- USB connection
- SMD antenna on board

Figure 1. STEVAL-SPBT2ATV2 dongle



Contents

1 Qualification 4

2 Demonstration board usage limitation 5

3 Recommended operating conditions 6

4 I/O connections 6

4.1 PAD description 6

4.2 Reset switch 7

5 Dongle layout 8

6 Dongle schematic 9

7 Getting started 10

7.1 Dongle installation 10

7.2 Setup and connect 12

7.2.1 Startup 13

7.2.2 Inquiry and available services 16

7.2.3 Command and answer syntax 22

7.2.4 GPIO and LED 23

7.3 Point-to-point connection 24

Appendix A USB driver installation 26

8 Revision history 29

List of figures

Figure 1. STEVAL-SPBT2ATV2 dongle . . . 1
Figure 2. Available pads . . . 6
Figure 3. Reset switch . . . 7
Figure 4. Dongle component layout . . . 8
Figure 5. Dongle electrical drawing . . . 9
Figure 6. USB drive installation first and second step . . . 10
Figure 7. Wizard installation first step . . . 10
Figure 8. Wizard installation second step . . . 11
Figure 9. Wizard installation third step . . . 11
Figure 10. Wizard installation completed . . . 11
Figure 11. Windows device manager . . . 12
Figure 12. Basic setup . . . 13
Figure 13. Connection setup . . . 14
Figure 14. Connection port setup . . . 14
Figure 15. Port parameters . . . 14
Figure 16. Connection properties setup . . . 15
Figure 17. AT command prompt . . . 15
Figure 18. BDAddress dongle1, dongle2 . . . 16
Figure 19. Discovery dongle1 . . . 16
Figure 20. Service dongle1 . . . 17
Figure 21. Bonding dongle1, dongle2 . . . 18
Figure 22. Connection dongle1, dongle2 . . . 18
Figure 23. Escape dongle1, dongle2 . . . 19
Figure 24. Return to bypass mode dongle1, dongle2 . . . 19
Figure 25. Disconnection dongle1, dongle2 . . . 20
Figure 26. Smart cable dongle1, dongle2 . . . 21
Figure 27. Automatic retrial dongle1 . . . 21
Figure 28. Automatic connection dongle1, dongle2 . . . 22
Figure 29. Change syntax dongle1 . . . 23
Figure 30. GPIO set dongle1 . . . 24
Figure 31. Point-to-point connection . . . 25
Figure 32. USB driver installation launch . . . 26
Figure 33. License agreement . . . 26
Figure 34. Wizard installation 1 . . . 27
Figure 35. Wizard installation 2 . . . 27
Figure 36. Wizard installation 3 . . . 27
Figure 37. Wizard installation terminated . . . 28
Figure 38. Installation completed . . . 28

1 Qualification

Bluetooth module SPBT2532C2.AT is CE, BQB qualified, and FCC compliant.

CE Registration: 0307-ARAJ00079

Measurements have been performed in accordance with (report available on request):

- EN 300 328 V 1.7.1 (2004-11): “electromagnetic compatibility and radio spectrum Matters (ERM); Wideband transmission systems; data transmission equipment operating in the 2.4 GHZ ISM band and using wideband modulation techniques; harmonized EN covering essential requirements under article 3.2 of the R&TTE directive”
- EN 301 489-17 V 1.2.1:2002: “electromagnetic compatibility and radio spectrum Matters (ERM); electromagnetic compatibility (EMC) standard for radio equipment and services; part 17: specific condition for 2.4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment”.
- EN 60950-1: “Information technology equipment - safety - part 1: General requirements”

BQB QI ID: B016360

- The module is listed as:
  - Product type: end product
  - TGP version: core 2.1/2.1 + EDR TCRL-2009-1
  - Core spec version: 2.1/2.1 + EDR
  - Product description: Bluetooth module

FCC compliance

FCC qualification is strictly related to RF section design; therefore it doesn’t apply to the module without antenna on board.

However, the SPBT2532C2.AT module even if not formally qualified, is FCC compliant. In fact it is a sub-set of the qualified module with antenna, SPBT2532C2A.AT; FCC ID X3ZBTMOD2.

2 Demonstration board usage limitation

The dongle based on the SPBT2532C2.AT module is not qualified; it is a pure demonstration tool only for evaluation purpose and not a product in itself.

3 Recommended operating conditions

Table 1. Recommended operating conditions

Symbol	Parameter	Conditions	Min.	Typ	Max	Unit
V_{DD}	Board supply voltage	-40 °C < T < 85 °C	4	5	6	V
Top	Operating case temperature range		-40		+85	°C

4 I/O connections

4.1 PAD description

Other than the USB plug, some pads are also available. In fact TP1 and TP2 pads make the SPBT2532C2.AT pins available to the user.

Figure 2. Available pads

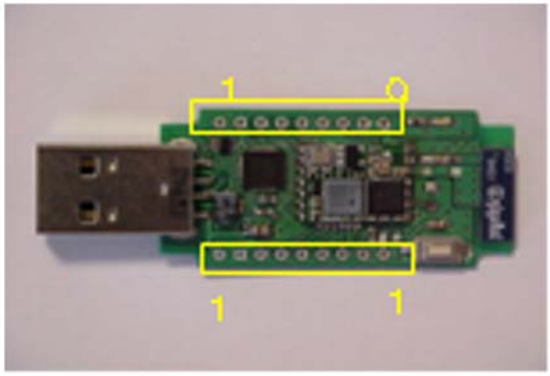


Table 2 lists the meaning of these pads.

Table 2. Pad connections

Pads		Description
TP	1	Reset - connected in parallel to onboard reset switch
	2	SPBT2532C2.AT supply voltage
	3	Boot pin - used for firmware downloading - used for testing purposes
	4	GPIO01 - general purpose I/O – LED5 is connected to this pin
	5	GPIO02 - general purpose I/O – LED4 is connected to this pin
	6	GPIO03 - general purpose I/O – LED3 is connected to this pin
	7	GPIO04 - general purpose I/O – LED2 is connected to this pin
	8	GND
	9	GND
	10	USB + (5 V)
	11	GND
	12	Used for testing purposes
	13	Used for testing purposes
	14	Used for testing purposes
	15	Used for testing purposes
	16	Used for testing purposes
	17	Used for testing purposes
	18	3.3 V

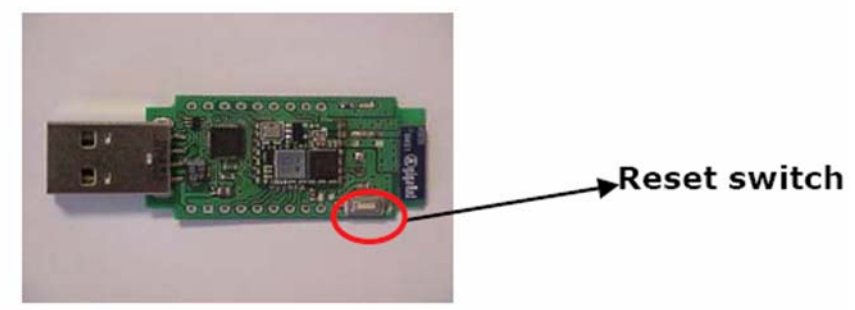
4.2 Reset switch

A reset switch SW1 is present on the dongle. When SW1 is pushed SPBT2532C2.AT is forced to reset.

The following prompt is displayed on the screen:

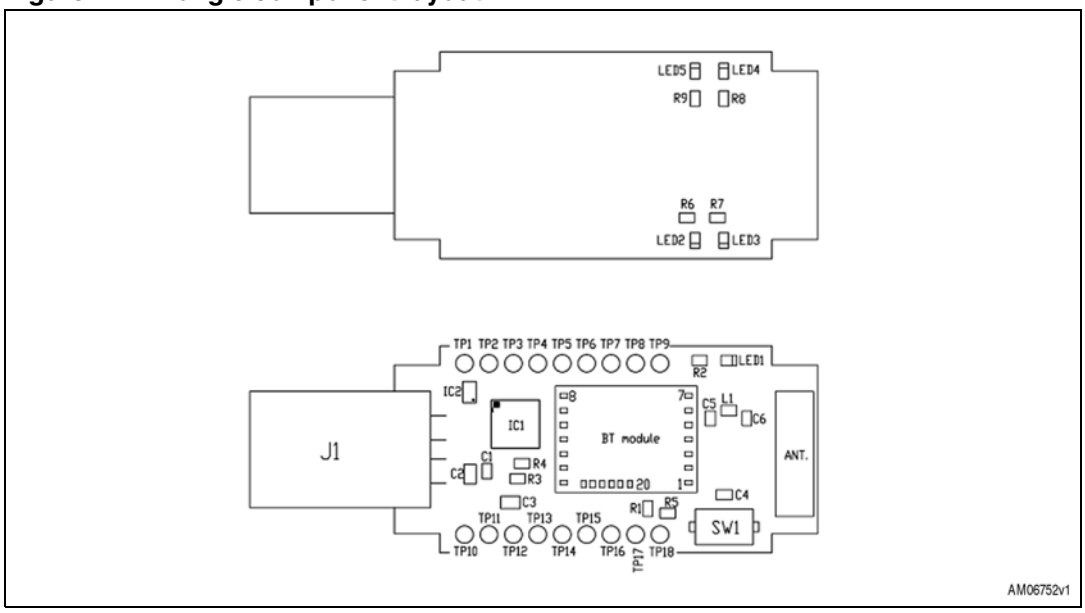
- AT-AB - command mode
- AT-AB BDAddress xxxxxxxxxxxx

Figure 3. Reset switch



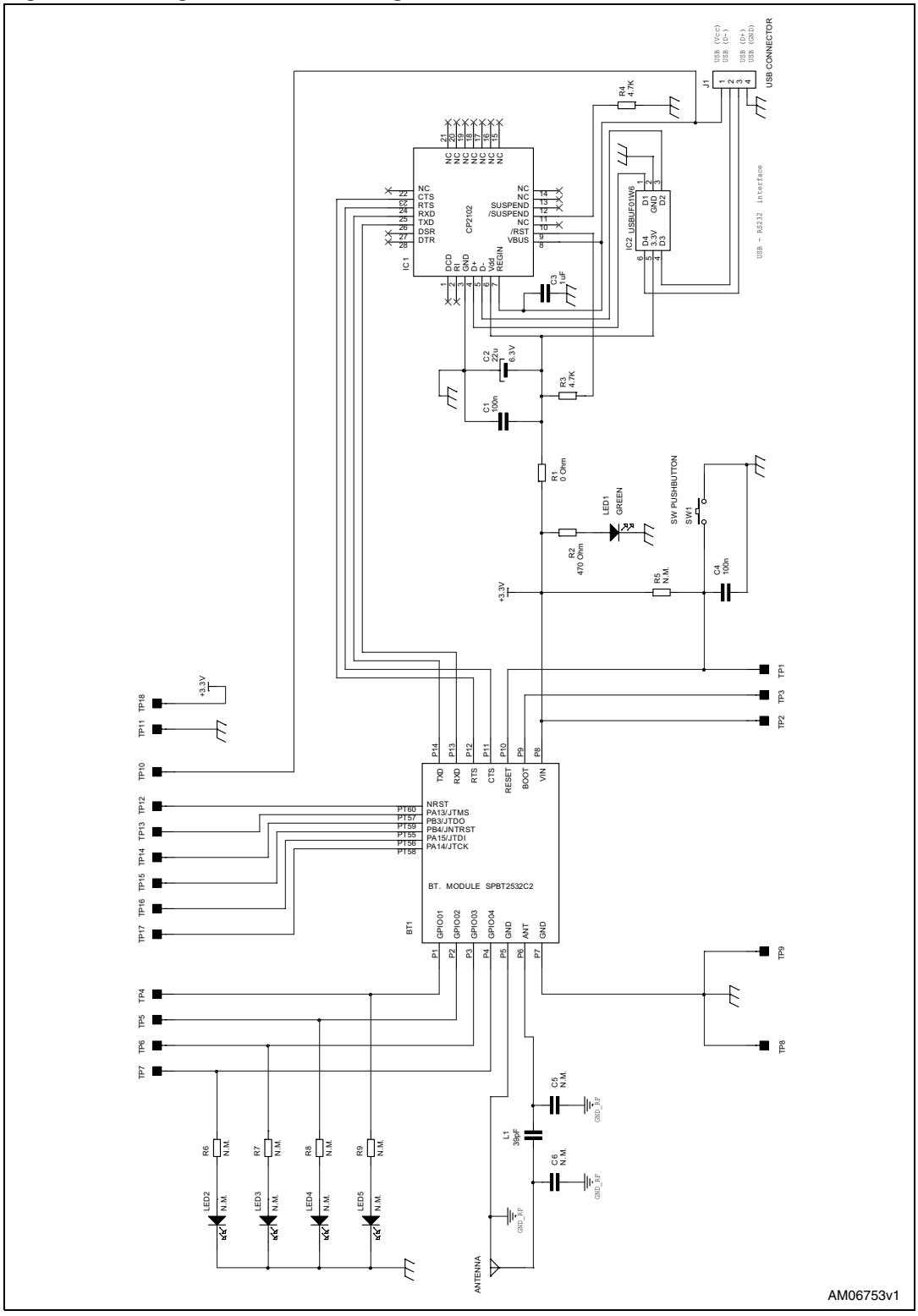
5 Dongle layout

Figure 4. Dongle component layout



6 Dongle schematic

Figure 5. Dongle electrical drawing



7 Getting started

7.1 Dongle installation

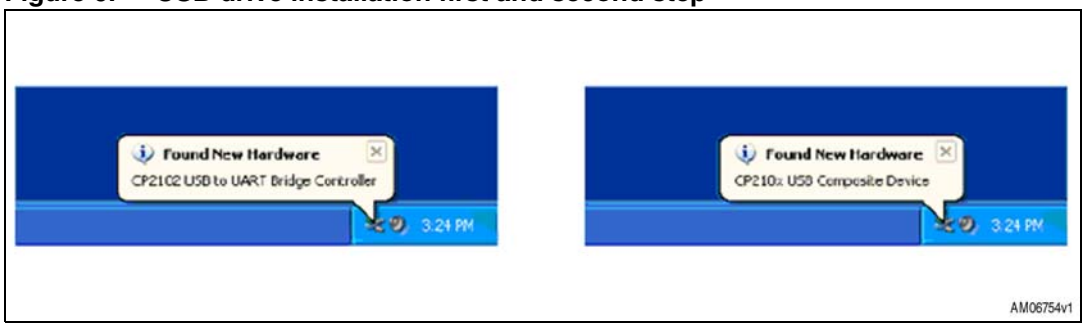
The Bluetooth SPBT2532C2.AT module and the related dongle do not need any Bluetooth driver on the host processor. However, before using a new USB device you need to install it on your PC.

If the USB driver is not present on the PC you need to apply a simple installation procedure as follows:

- Step 1:

  Simply plug the STEVAL-SPBT2ATV2 into any available USB port. The computer responds with the following two messages:

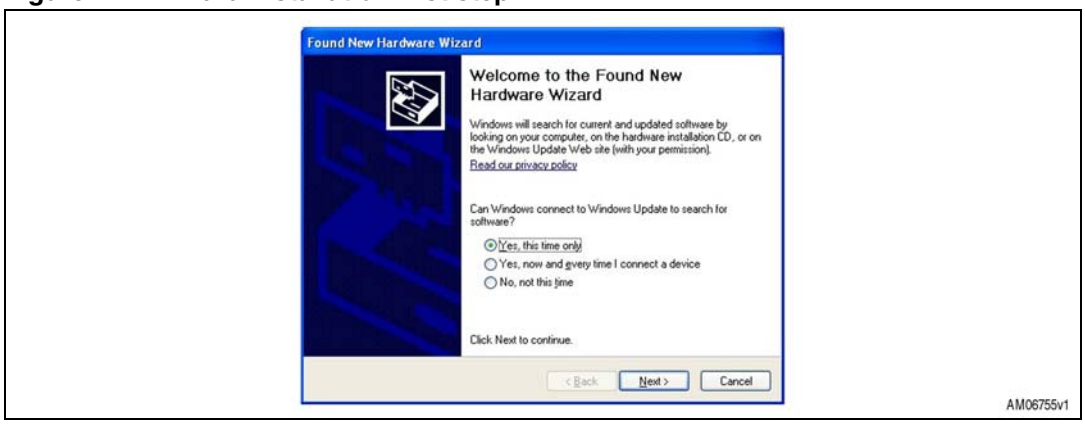
Figure 6. USB drive installation first and second step



- Step 2:

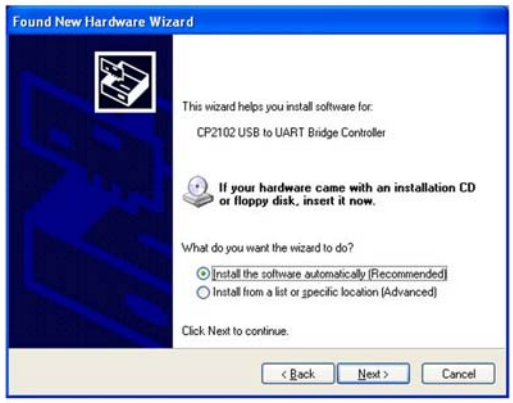
  Next, Windows launches a “Found New Hardware Wizard” installation window. Select Yes to locate the drivers from the Microsoft website.

Figure 7. Wizard installation first step



Click Next to install automatically.

Figure 8. Wizard installation second step



Now the STEVAL-SPBT2ATV2 USB to UART controller and virtual COM port driver is installed.

- Step 3:

The “Found New Hardware Wizard” now opens again in order to install the USB device driver.

Select Yes to locate the drivers from the Microsoft website.

Figure 9. Wizard installation third step

The following message appears:

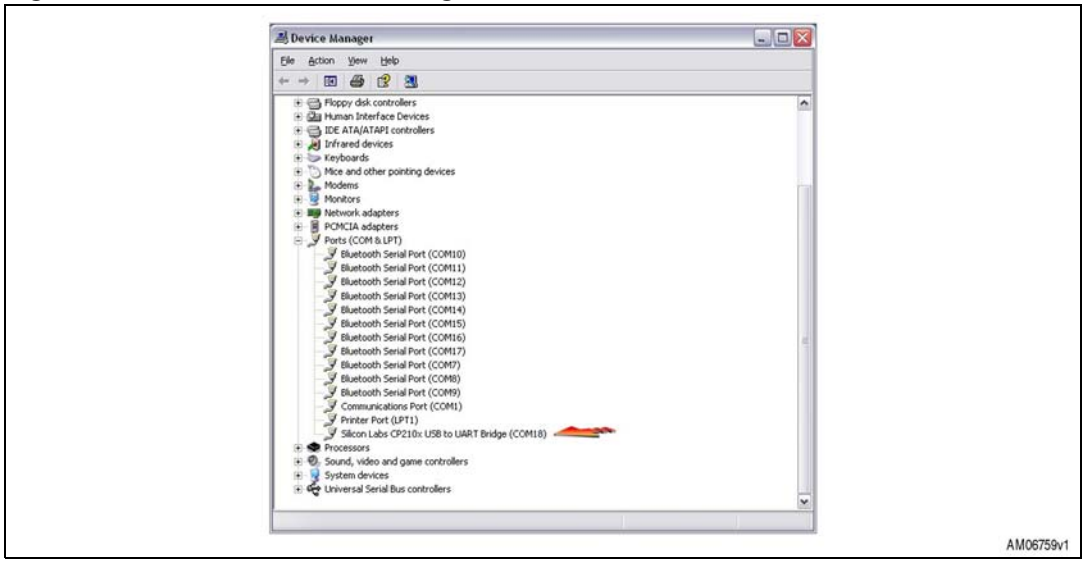
Figure 10. Wizard installation completed

- Step 4:

Open the Windows device manager application to verify correct installation, and see which COM port has been assigned to the STEVAL-SPBT2ATV2 Bluetooth serial device. The STEVAL-SPBT2ATV2 is usually assigned the same virtual COM port each time it is inserted (unless there are other virtual COM devices altering port assignments).

Two device drivers for the STEVAL-SPBT2ATV2 Bluetooth device should be seen here.

Figure 11. Windows device manager



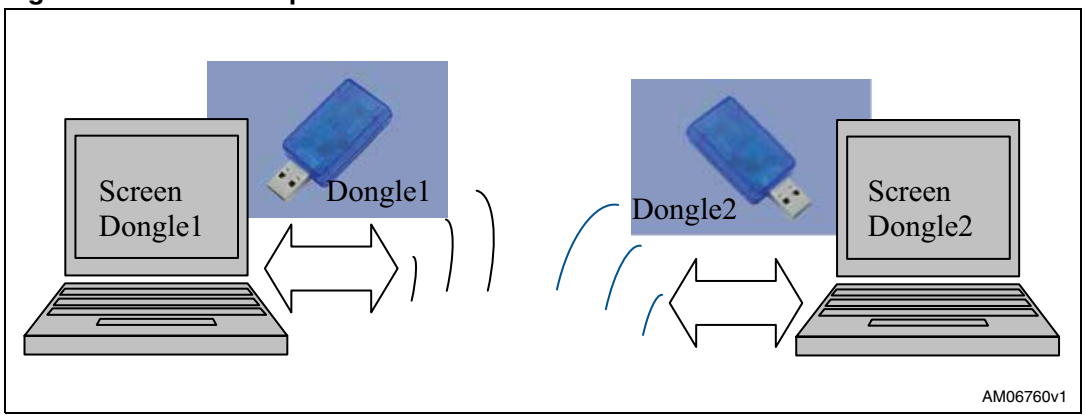
The CP2102 chip provides the function of using standard UART serial communications from the computer via the universal serial bus, and interfaces directly to the Bluetooth module inside the STEVAL-SPBT2ATV2 Bluetooth serial adapter. If USB driver wizard installation fails, follow *Appendix A: USB driver installation* installation procedure.

7.2 Setup and connect

The purpose of this section is to describe all the necessary steps to establish a connection between two Bluetooth STEVAL-SPBT2ATV2 dongles realizing a serial line/cable replacement application.

Two PCs and two STEVAL-SPBT2ATV2 boards are needed to perform the connection.

Figure 12. Basic setup



(Please refer to the SPBT2532C2.AT datasheet appendix C, for listing and meaning of the AT commands).

7.2.1 Startup

Two dongles are needed to perform the connection.

Each dongle has its own BD address. Suppose 0080e1f00001 for dongle1 and 0080e1f00002 for dongle2

Each dongle has the following factory default:

- UART: 115200 baud, no parity,1 stop bit,8 data bits
- Local name: “Amp'ed UP!’
- Class of device: Misc Device
- Profile: SPP (serial port profile)
- Service name: “AMP-SPP”
- Deep sleep: disabled
- Page and inquiry scan: 1.28s interval, 11 ms duration
- Security: disabled
- Bonding PIN: “1234”
- Bonding allowed: always enabled

- Plug each dongle into a PC using the USB connector
- Open the HyperTerminal program on both PCs and create a new connection “AT Command”

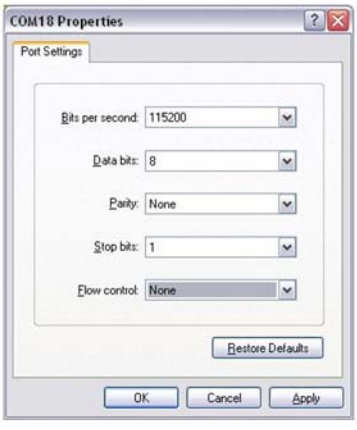
Figure 13. Connection setup

Set the connection port:

Figure 14. Connection port setup

and configure it:

Figure 15. Port parameters

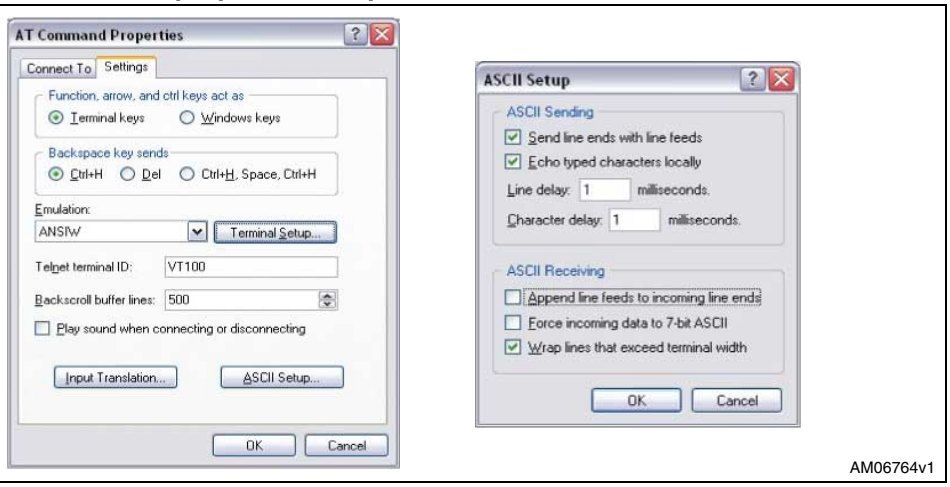


with the following parameters:

- Select the proper COM line (COM1, COM2……)
- Set baud rate = 115000 (default baud rate of SPBT2532C2.AT module)
- Set data bits= 8
- Set stop bits= 1
- Set parity= none
- Set flow control= none

From the menu file set the AT command connection properties:

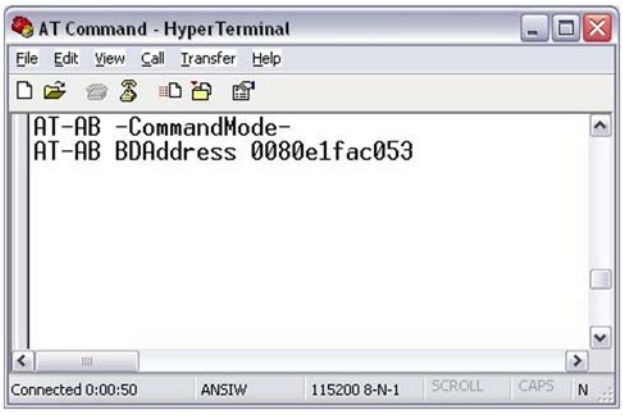
Figure 16. Connection properties setup



The dongle is ready to use:

- Press the reset switch on the dongle
- On the screen the prompt followed by the module Bluetooth address should appear:

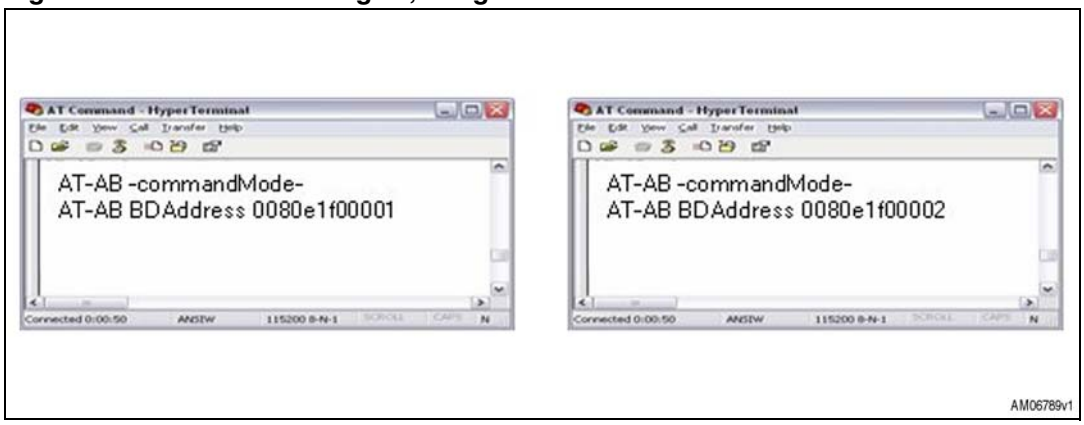
Figure 17. AT command prompt



“AT-AB -Command Mode -”

“AT-AB BDAddress xxxxxxxxxxxx”

Figure 18. BDAddress dongle1, dongle2



7.2.2 Inquiry and available services

Before establishing a connection, the dongle must know which Bluetooth devices are present and which services are offered. Each module has its own address which identifies the module itself in the network. The BD address can be found during the discovery phase.

If the BD address of the Bluetooth device you want to connect to is known, the inquiry procedure can be omitted.

- Discovery:
  - AT+AB discovery

This command returns the number of responses of nearby devices and then the individual responses with BD address, and name of device. The number of devices returned is limited to 10.

Inquiry is performed with an interval of 10.24 seconds.

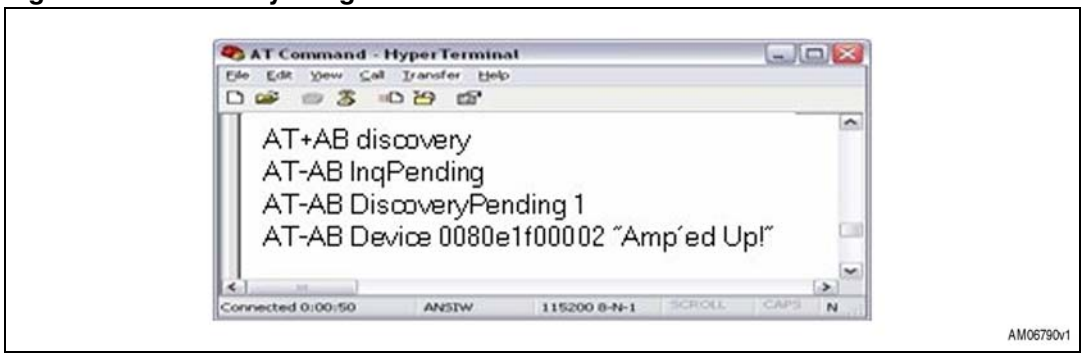
The devices are reported in the same order as the original inquiry results.

For each name or service name request that is successful, the response uses the returned names in the following format:

- AT-AB Device [BD addr] [name]
- AT-AB Device [BD addr] Unknown

As a consequence of a discovery command issued by dongle1, the following lines are displayed:

Figure 19. Discovery dongle1



Note: In case of 1 device found.

- Service:

To verify at the same time which kind of service is available use the command:

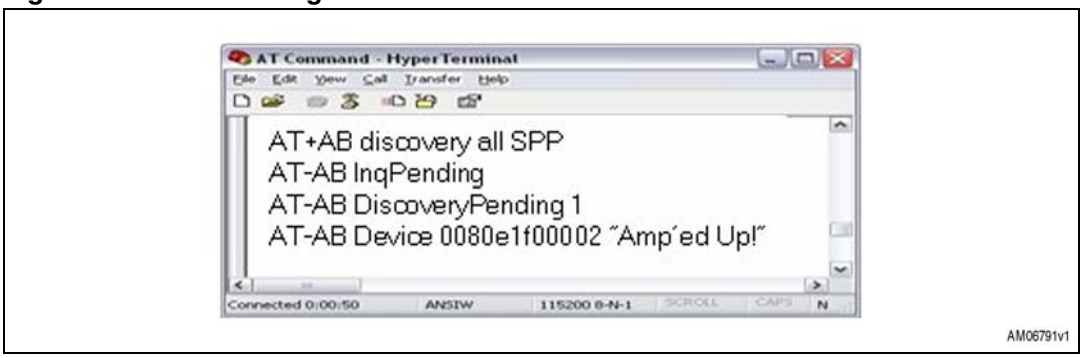
AT+AB discovery [CoD] [profile]

Response is:

AT-AB Device [BD addr] [name]

As a consequence of a discovery command for SPP service issued by dongle1, the following appears on the screen:

Figure 20. Service dongle1



Note: In case of 1 device found.

- Bonding:

Bonding is used when an application needs to pair with another remote device. Devices must be enabled to bond, with this aim we use the EnableBond command. The BD Address, PIN and timeout parameters are optional.

  – AT+AB EnableBond

If the operation is successful, the response is:

  – AT-AB BondEnabled

To bond devices the “bond command” is used where the device address and the identification number (PIN) is specified.

The command is:

  – AT+AB bond [BD addr] [Pin]

If the request is successfully submitted the response is:

  – AT-AB BondPending [BD addr]

If the operation is successful the response is:

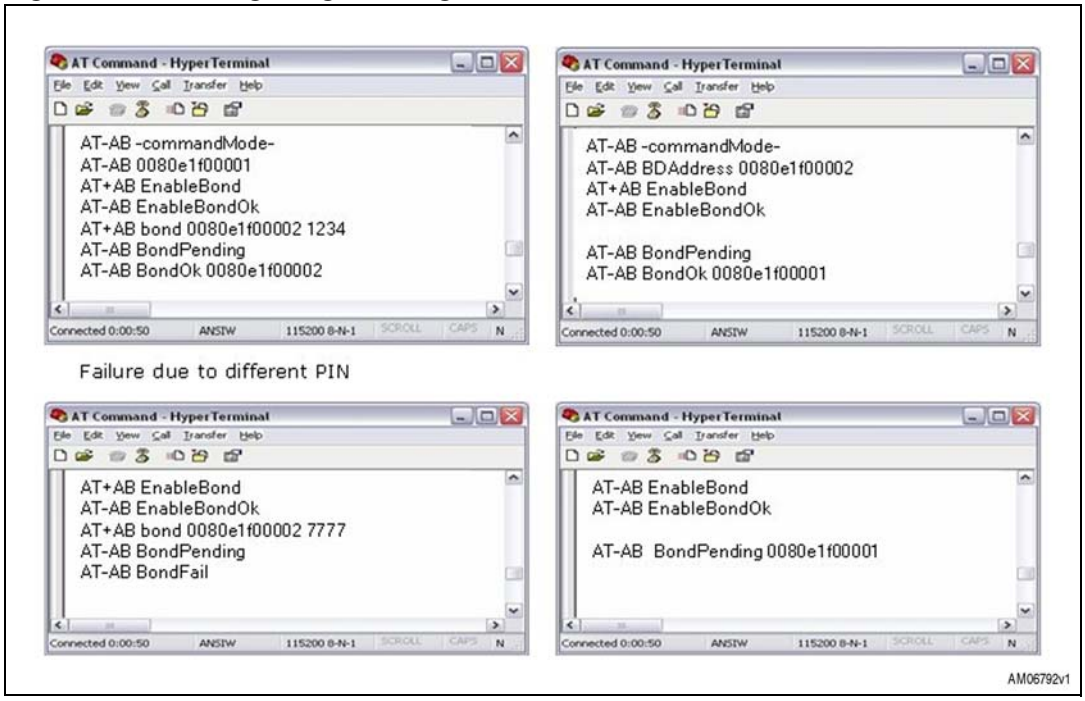
  – AT-AB BondOk

If it fails:

  – AT-AB BondFail

In this case dongle1 is requesting a bonding with dongle2.

Figure 21. Bonding dongle1, dongle2



- Connection:

Once the dongle knows the device present and the service offered, the command to setup connection is:

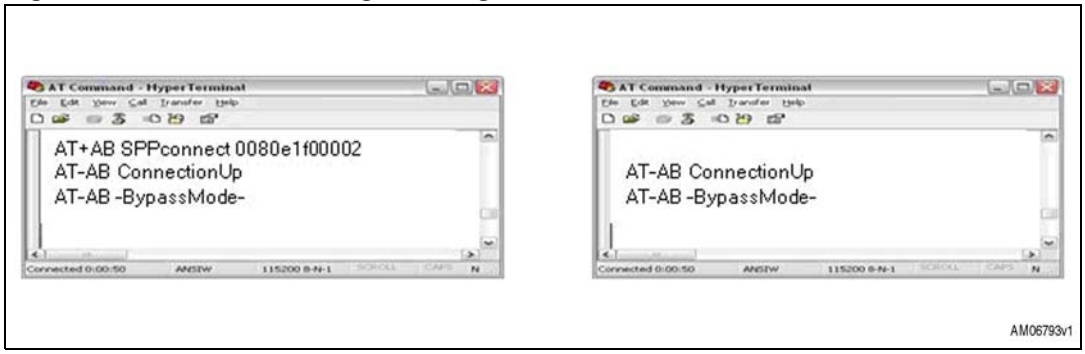
  – AT+AB SPPconnect [BD Addr] [Service]

If the connection is successful, the response is:

  – AT-AB ConnectionUp
  – AT-AB -BypassMode-

At this point the connection is established. The dongles can send and receive data. In this case, dongle1 knows the address of dongle2, and wants to connect to dongle2:

Figure 22. Connection dongle1, dongle2



Now the two dongles are connected to one another and in bypass mode.

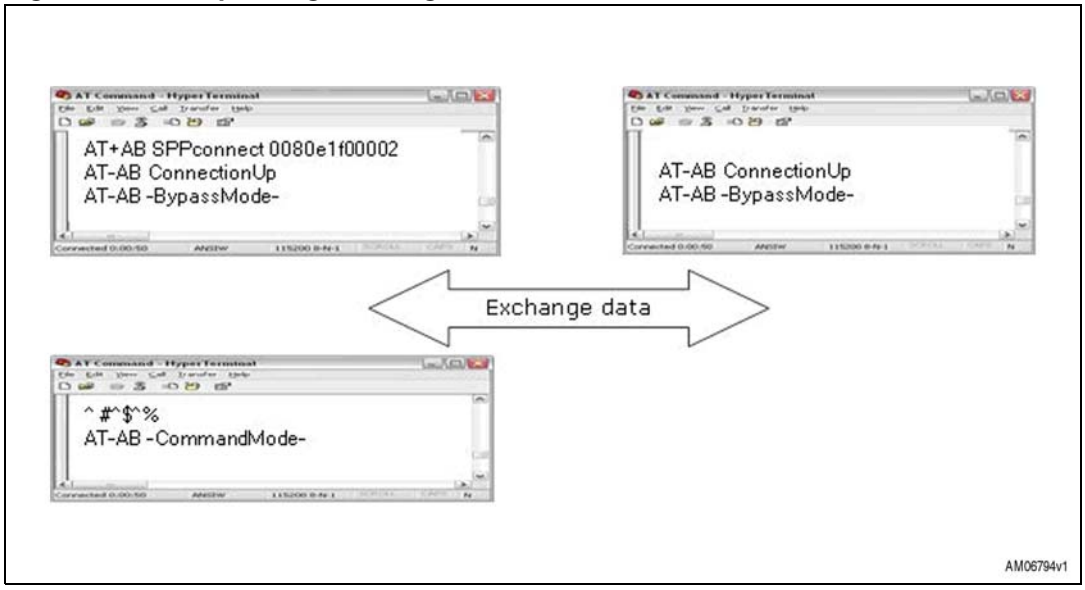
In other words, everything typed on a terminal is transferred to the other via the Bluetooth link and vice versa. In bypass mode the dongle doesn't answer the commands.

If, for example, the user needs to change some parameters of a dongle it's necessary to switch to -command mode-, giving the "escape command".

The escape command is a special sequence of characters followed by at least two seconds of inactivity on the serial port.

The escape command sequence is: ^ #^$^%

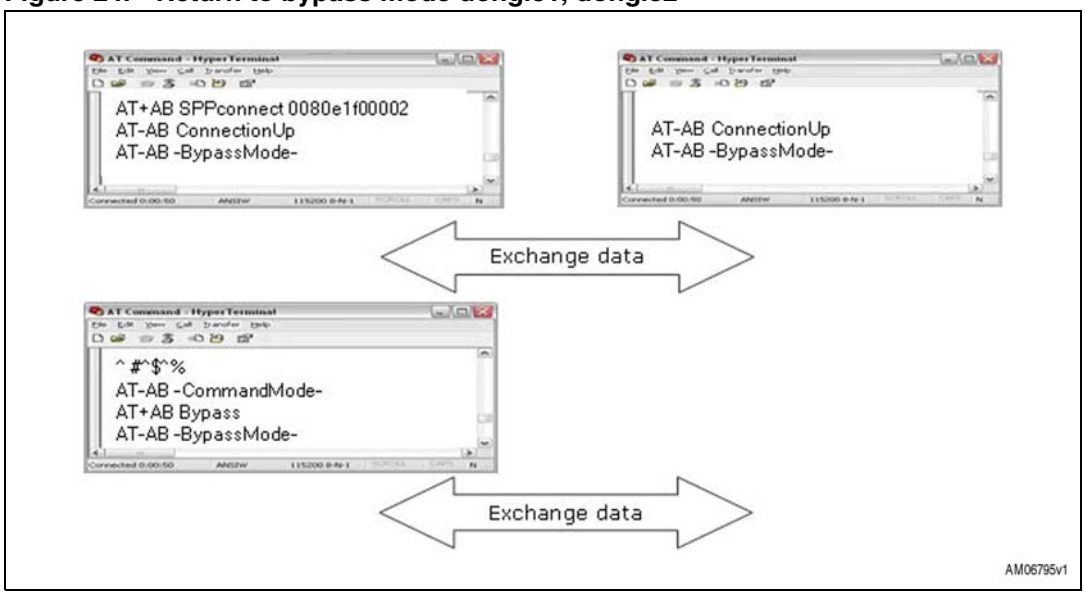
Figure 23. Escape dongle1, dongle2



As can be noted, the escape command given to dongle1 doesn't affect dongle2 which remains in bypass mode.

Connection between the two dongles is still active; to return to the "exchange data" situation, dongle1 must be reconfigured in bypass mode with the command "Bypass".

Figure 24. Return to bypass mode dongle1, dongle2



Now the two dongles can exchange data again.

- Disconnection:

The SPPDisconnect command is used to terminate a connection with the remote device.

– AT+AB SPPDisconnect

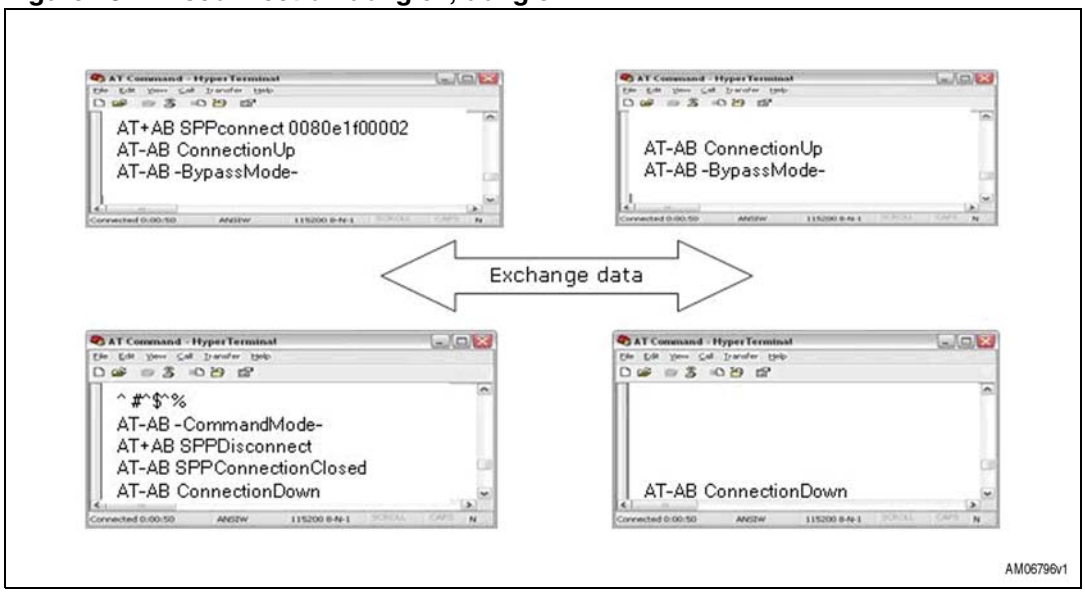
If the disconnection is successful, the response is:

– AT-AB SPPConnectionClosed

SPPDisconnect is a command; it is recognized and accepted by the dongle only if the dongle is in -command mode-.

If the dongle is in bypass mode send the “escape command” before giving the disconnection command.

Figure 25. Disconnection dongle1, dongle2



Information related to successful disconnection is displayed on both screens.

- Smart cable setup:

The smart cable setup command is used to enable and configure a SmartCable device.

A device BD address is specified with which to automatically establish a connection, replacing the need for AT connection commands.

It is stored in the non-volatile memory.

The command is:

– AT+AB SmartCableSetup [BD Addr] [Attempts] [Interval]

If the command is successful, the response is:

– AT-AB SmartCableConfigDone

In this case, suppose an automatic connection of dongle1 to dongle2 at power-on is needed, with the possibility to retry for 5 times with an interval of 1 sec between each retry.

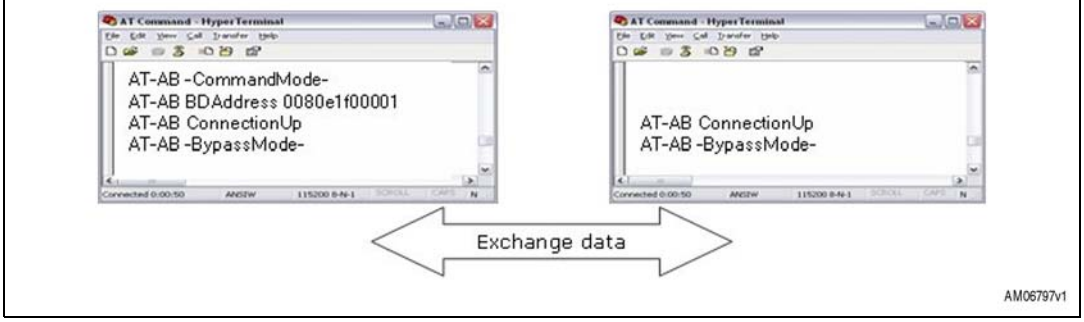
The command is:

– AT+AB SmartCableSetup 0080e1f00002 5 1

This command is stored inside the non-volatile memory and executed at power-on.

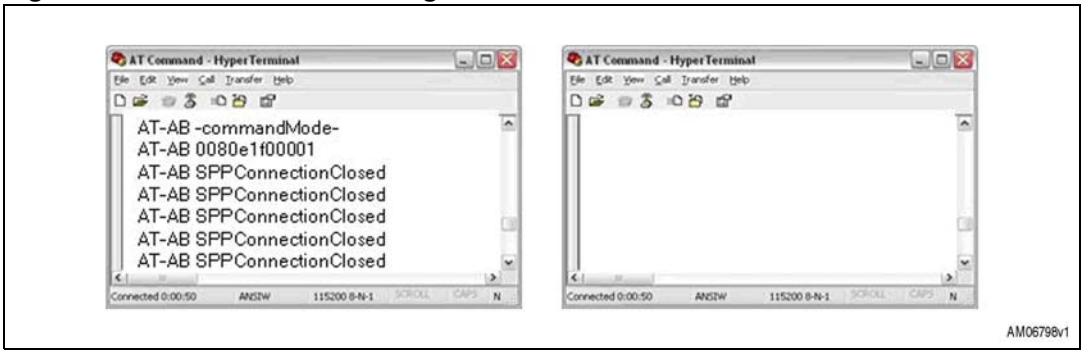
In case dongle2 is already powered:

Figure 26. Smart cable dongle1, dongle2



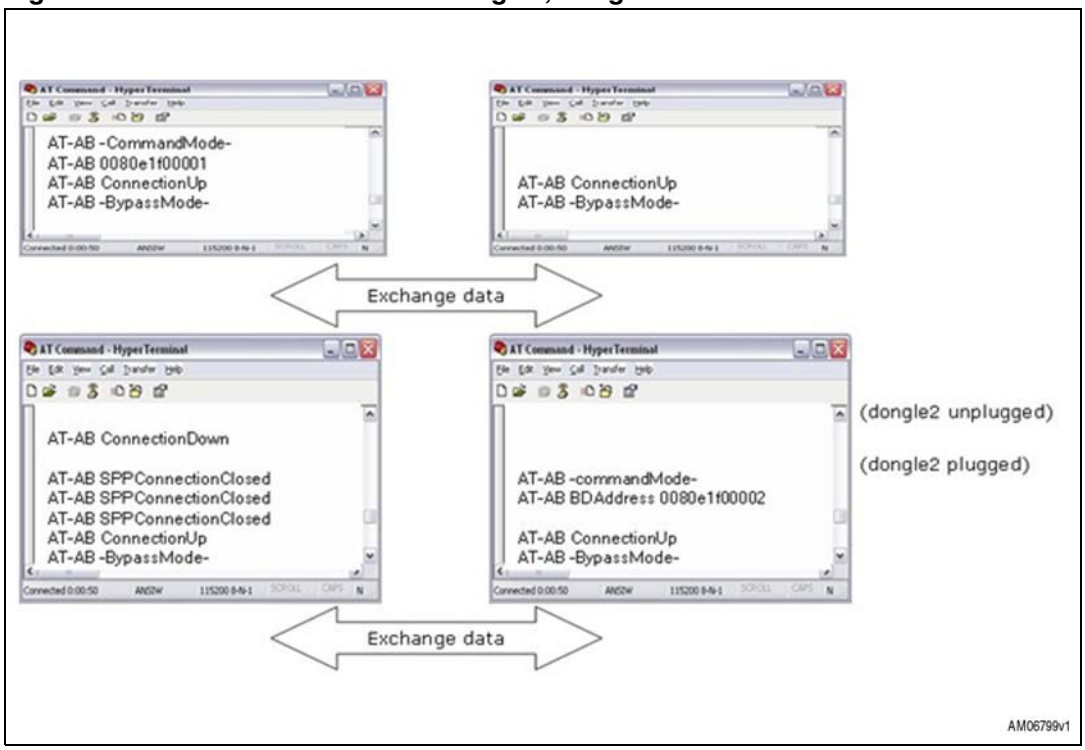
If dongle2 is not powered or not available, dongle1 automatically retries 5 times.

Figure 27. Automatic retrial dongle1



If dongle2 is present, dongle1 automatically connects. If dongle2 is unplugged, connection fails. However connection is automatically restored if dongle2 is again plugged in during the interval of retrial assigned to dongle1.

Figure 28. Automatic connection dongle1, dongle2



- Delete smart cable setup:

The command to remove the SmartCableSetup is:

  – AT+AB DeleteSmartCable

if the operation is successful the answer is:

  – AT-AB DeleteSmartCableDone

To give the command the dongle must be in; -command mode-.

- Erase bond table:

The erase bond table command must be used to clear all the bonded device entries:

  – AT+AB EraseBondTable

if the operation is successful the answer is:

  – AT-AB BondTableErased

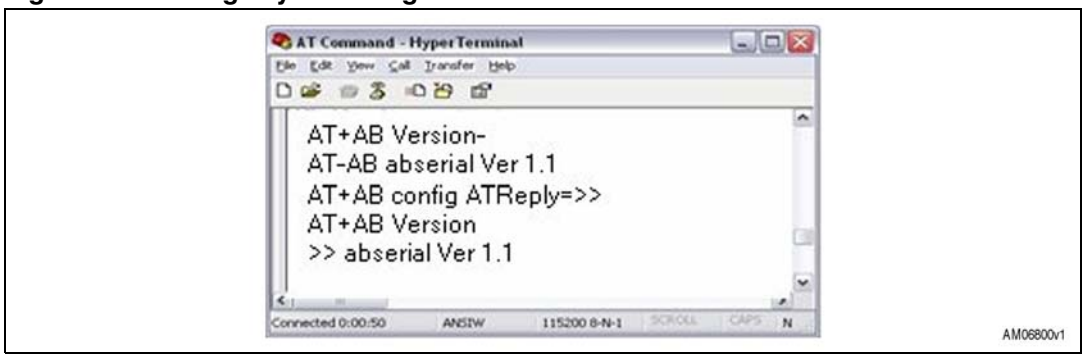
7.2.3 Command and answer syntax

The syntax of the commands is fixed and cannot be changed, the prefix for each command is AT+AB.

Each command has an answer which is preceded by the prefix AT-AB; this identifier can be changed by means of the AT+AB config command.

If it's necessary to change the prefix of the answer from AT-AB to ">>" on dongle1, the steps to follow are shown in *Figure 29*:

Figure 29. Change syntax dongle1



Note: Change reply prefix.

7.2.4 GPIO and LED

On the dongle there are 4 LEDs connected to GPIO 1-4. Each LED can be switched on/off by driving the corresponding GPIO.

GPIO must be configured for Output or Input using the proper command:

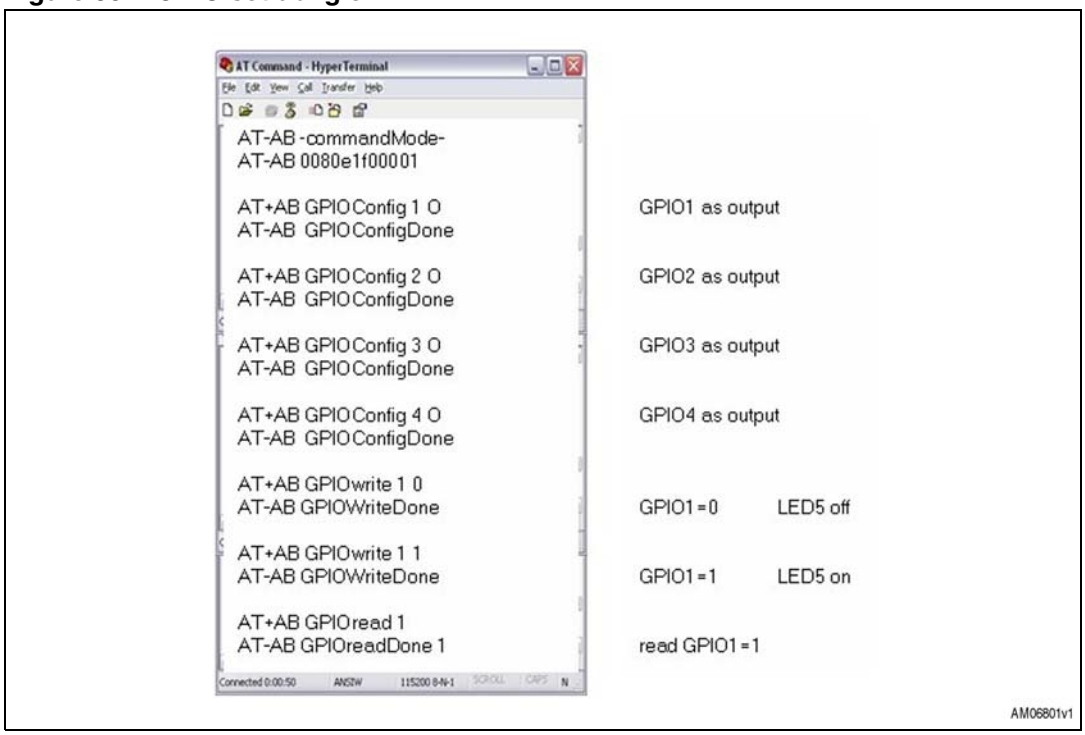
- AT+AB GPIOConfig [GPIO Pin] I for input
- AT+AB GPIOConfig [GPIO Pin] O for output

Once configured the GPIO port can be read or written with the commands:

- AT+AB GPIOWrite [GPIO Pin] 1 write 1
- AT+AB GPIOWrite [GPIO Pin] 0 write 0
- AT+AB GPIORead [GPIO Pin] read

Example:

Figure 30. GPIO set dongle1



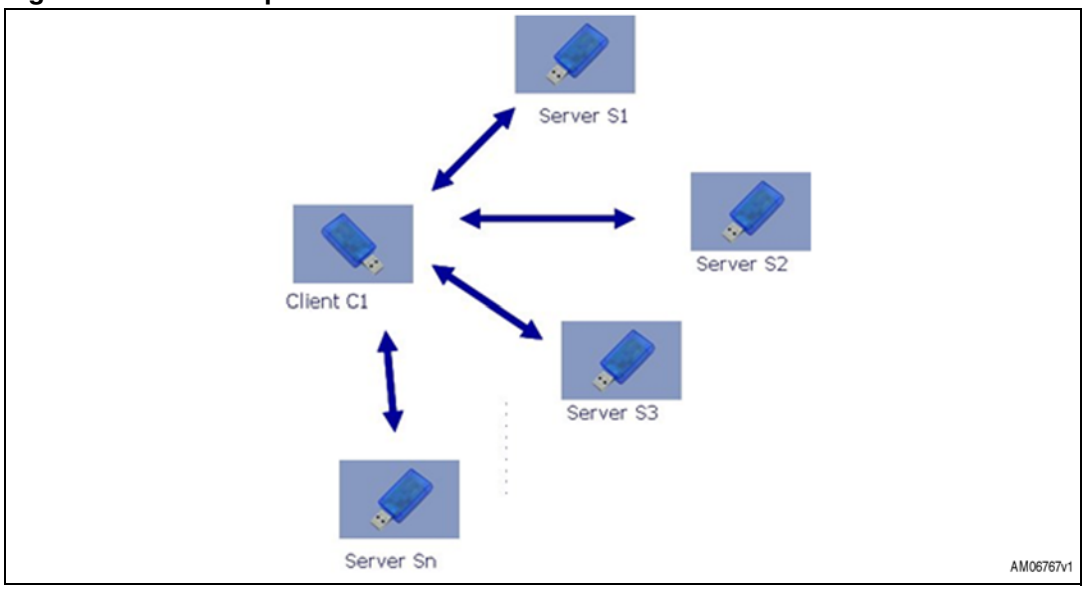
7.3 Point-to-point connection

Modules with AT command firmware can only perform point-to-point connections. Only one connection can be activated at once.

A module can be connected to several other modules, but it must disconnect from the previous connection before activating a new one.

Figure 31 shows an example of a client C1 which needs to connect to Server S1, S2, and Sn:

Figure 31. Point-to-point connection



In this case the following procedure must be used:

- C1 establishes the connection to S1 to exchange data
- C1 disconnects from S1 using the command AT+AB SPPDisconnet
- C1 establishes the connection to S2 to exchange data
- C1 disconnects from S2 using the command AT+AB SPPDisconnet
- C1 establishes the connection to Sn to exchange data…etc.

Appendix A USB driver installation

In a case where USB driver wizard installation fails, the dongle can be installed using the drive available on the silicon lab website at www.silabs.com/support/pages/support.aspx?ProductFamily=USB+to+UART&PartNumber=cp2102.

Insert the dongle into a USB port on the PC, follow these steps described in *Section 7.1* of this document.

Figure 32. USB driver installation launch

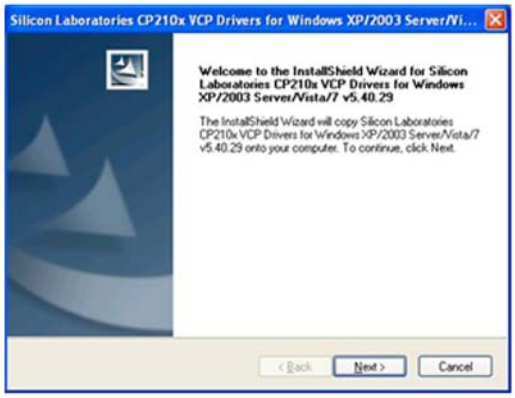


Figure 33. License agreement

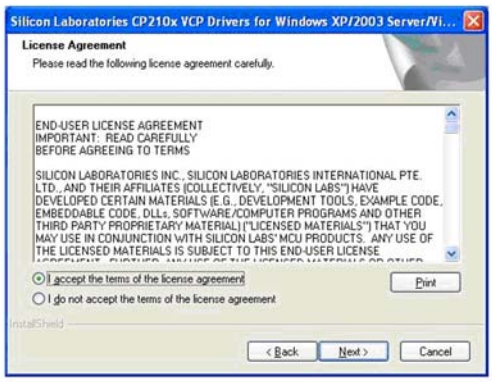


Figure 34. Wizard installation 1

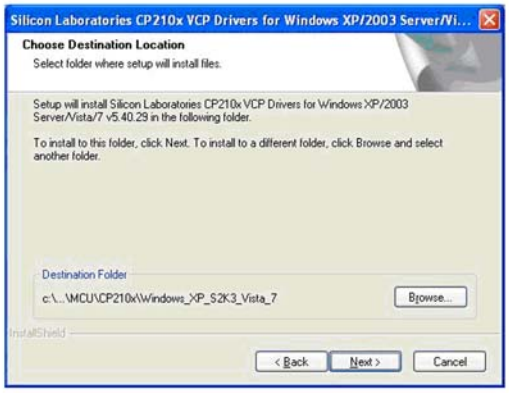


Figure 35. Wizard installation 2

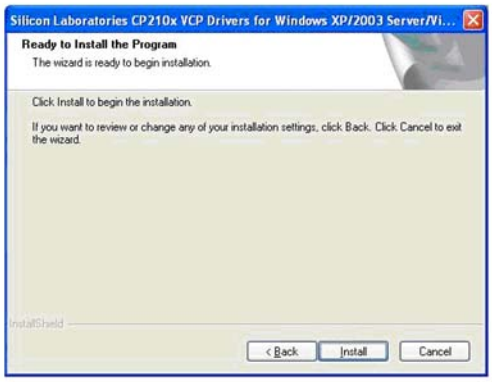


Figure 36. Wizard installation 3

Figure 37. Wizard installation terminated

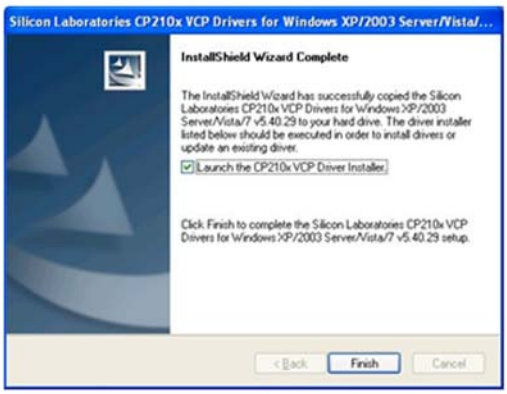
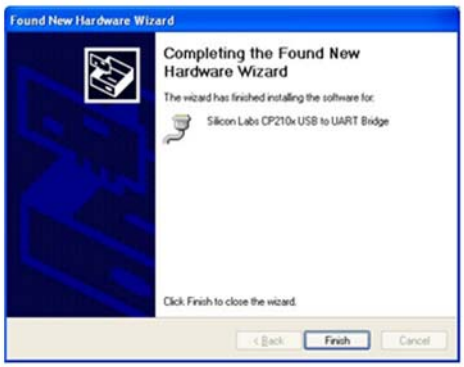


Figure 38. Installation completed



The USB driver installation is now complete.

8 Revision history

Table 3. Document revision history

Date	Revision	Changes
18-Jun-2010	1	Initial release.
04-Apr-2011	2	Code of the board changed: from STEVAL-SPBT2ATV1 to STEVAL-SPBT2ATV2

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